Science for a changing world

Onshore elevation data from California Coastal Conservancy (available at http://www.csc.noaa.gov/digitalcoast/data/coastallidar/) and from U.S. Geological Survey's National Elevation Dataset (available at

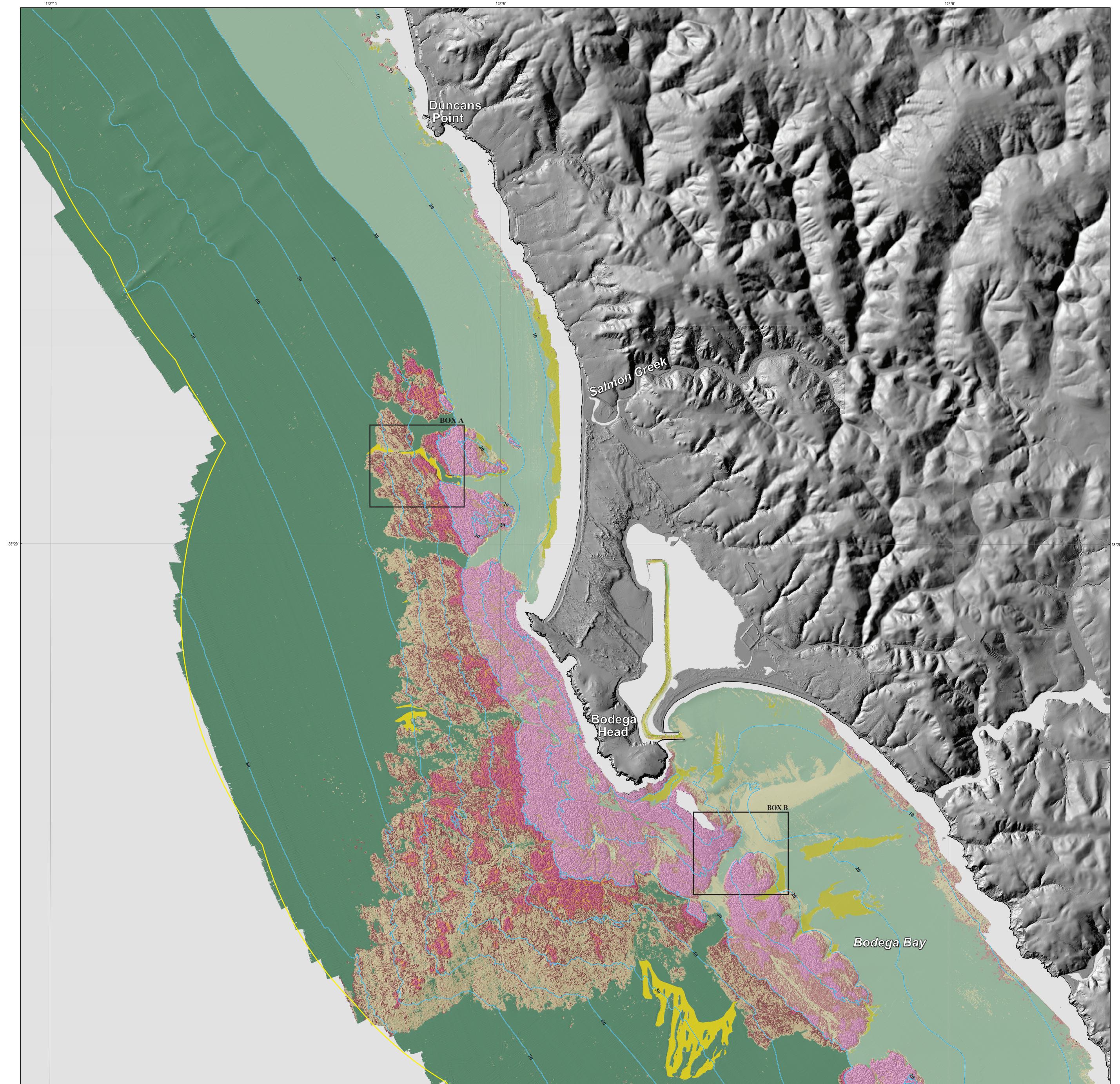
http://ned.usgs.gov/). Offshore shaded-relief bathymetry from map on

Universal Transverse Mercator projection, Zone 10N

NOT INTENDED FOR NAVIGATIONAL USE

sheet 2, this report. California's State Waters limit from NOAA Office of

U.S. Department of the Interior Open-File Report 2015–1140
U.S. Geological Survey Sheet 5 of 10



DESCRIPTION OF MAP UNITS

DEPTH ZONE 2—INTERTIDAL TO 30 METERS WATER DEPTH

SLOPE CLASS 1—0 TO 5 DEGREES

Fine- to medium-grained smooth sediment—Low backscatter, low rugosity; typically mud to medium-grained sand; often rippled and (or) burrowed

Mixed smooth sediment and rock—Moderate to very high backscatter, low rugosity; typically

coarse-grained sand, gravel, cobbles, and bedrock

Rock and boulder, rugose—High backscatter, high rugosity; typically boulders and rugose bedrock

Medium- to coarse-grained sediment—Very high backscatter, low rugosity; typically medium- to coarse-grained sediment, with varying amounts of shell hash; in scour depressions

SLOPE CLASS 2—5 TO 30 DEGREES

Fine- to medium-grained smooth sediment—Low backscatter, low rugosity; typically mud to medium-grained sand; often rippled and (or) burrowed

Mixed smooth sediment and rock—Moderate to very high backscatter, low rugosity; typically coarse-grained sand, gravel, cobbles, and bedrock

Rock and boulder, rugose—High backscatter, high rugosity; typically boulders and rugose bedrock

Medium- to coarse-grained sediment—Very high backscatter, low rugosity; typically medium- to coarse-grained sediment, with varying amounts of shell hash; in scour depressions

DEPTH ZONE 3—30 METERS TO 100 METERS WATER DEPTH

SLOPE CLASS 1—0 TO 5 DEGREES

Fine- to medium-grained smooth sediment—Low backscatter, low rugosity; typically mud to medium-grained sand; often rippled and (or) burrowed

Mixed smooth sediment and rock—Moderate to very high backscatter, low rugosity; typically coarse-grained sand, gravel, cobbles, and bedrock

Rock and boulder, rugose—High backscatter, high rugosity; typically boulders and rugose bedrock

Medium- to coarse-grained sediment—Very high backscatter, low rugosity; typically medium- to coarse-grained sediment, with varying amounts of shell hash; in scour depressions

SLOPE CLASS 2—5 TO 30 DEGREES

Fine- to medium-grained smooth sediment—Low backscatter, low rugosity; typically mud to medium-grained sand; often rippled and (or) burrowed

Mixed smooth sediment and rock—Moderate to very high backscatter, low rugosity; typically coarse-grained sand, gravel, cobbles, and bedrock

Rock and boulder, rugose—High backscatter, high rugosity; typically boulders and rugose bedrock

EXPLANATION OF MAP SYMBOLS

part of California Seafloor Mapping Program

3-nautical-mile limit of California's State Waters

Bathymetric contour (in meters)—Derived from modified 2-m-resolution bathymetry grid. Contour

Area of "no data"—Areas near shoreline not mapped owing to insufficient high-resolution seafloor

mapping data; areas beyond 3-nautical-mile limit of California's State Waters were not mapped as

DISCUSSION

This seafloor-character map of the Offshore of Bodega Head map area in northern California was produced using video-supervised, maximum-likelihood classification of the bathymetry and backscatter (intensity of return) signals from sonar systems (a summary of the video data collected for the purpose of supervising the classification is shown on sheet 6). Rugosity (a GIS-derived characterization of roughness) and backscatter intensity were used as variants in the classification. The interpreted classifications were then draped over shaded-relief bathymetry (see

interval: 10 m

The substrate classes mapped in this area have been divided into the following California Marine Life Protection Act depth zones: Depth Zone 2 (intertidal to 30 m), and Depth Zone 3 (30 to 100 m). In addition, the following slope classes are represented on this map (Coastal and Marine Ecological Classification Standard slope zones are shown in parentheses): Slope Class 1, 0° to 5° (flat); and Slope Class 2, 5° to 30° (sloping). Depth Zone 1 (intertidal), Depth Zones 4 and 5 (greater than 100 m), and Slope Classes 3 to 5, greater than 30° (steeply sloping to

overhang) are not present in this map area.

Fine- to medium-grained smooth sediment (sand and mud) makes up 69.3 percent (96.2 km²) of the map area:

22.7 percent (31.5 km²) is in Depth Zone 2, and 46.6 percent (64.7 km²) is in Depth Zone 3. Mixed smooth sediment

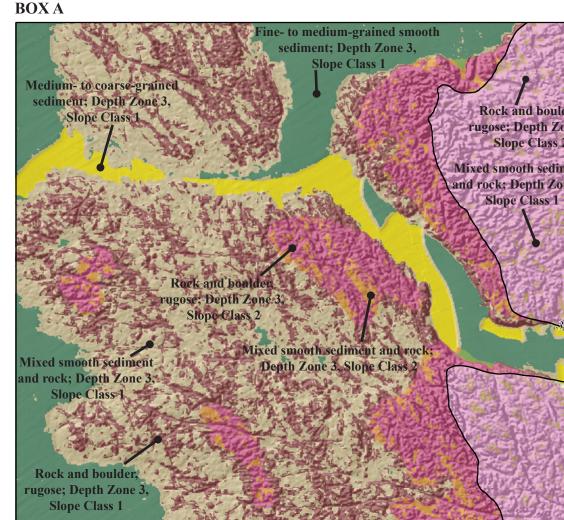


Figure 1. Detailed view of substrate classes mapped northwest of Bodega Head (see Box A, on map, for location): Depth Zone 2 (intertidal to 30 m), Depth Zone 3 (30 to 100 m), Slope Class 1 (0°–5°), and Slope Class 2 (5°–30°). Fine- to medium-grained smooth sediment is shown in shades of green; mixed smooth sediment and rock is shown in shades of tan; rock is shown in shades of pink; and medium- to coarse-grained sediment is shown in shades of

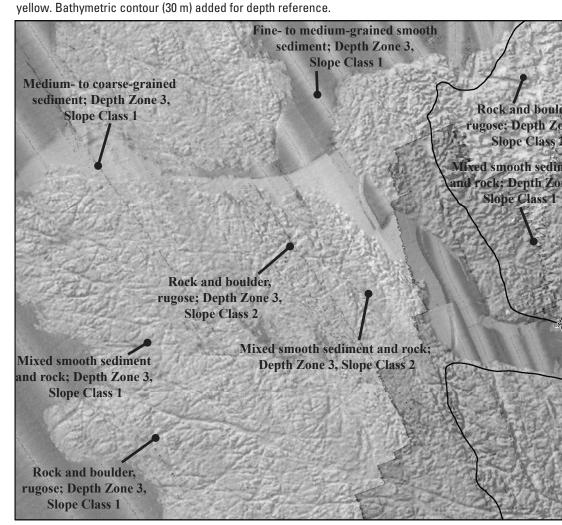


Figure 2. Acoustic-backscatter image (see sheet 3) draped over shaded-relief bathymetry (see sheet 2) for same area as figure 1 (Box A on map). Brighter areas indicate coarse-grained, rough, or hard seafloor; darker areas indicate unconsolidated (loosely packed) sediment. Parallel light-gray lines and series of short dark-gray dashes

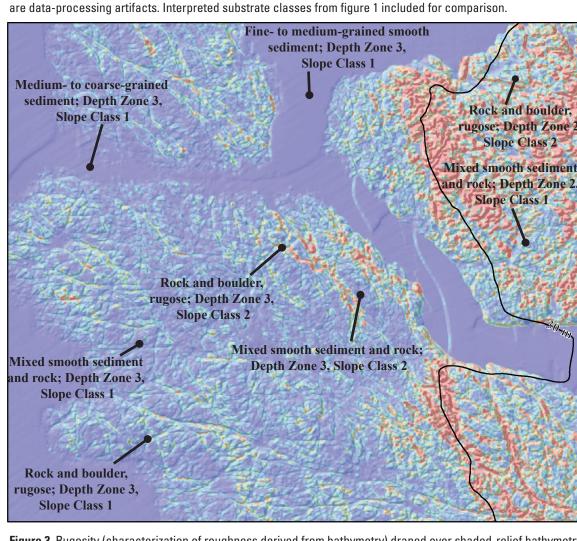


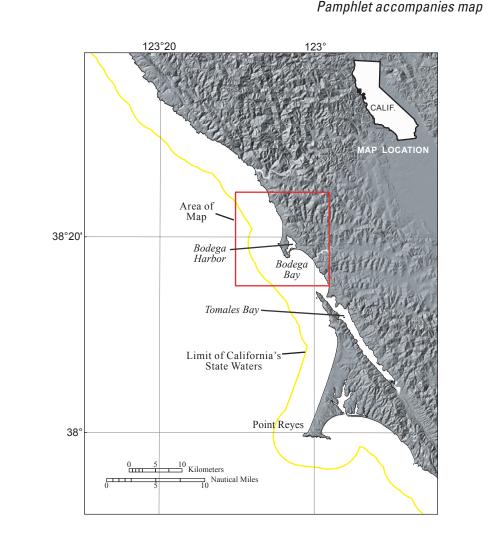
Figure 3. Rugosity (characterization of roughness derived from bathymetry) draped over shaded-relief bathymetry (see sheet 2) for same area as figure 1 (Box A on map). Rugosity values are displayed in muted "rainbow" color spectrum that ranges from purple (low rugosity) through green (medium rugosity) to red (high rugosity). Interpreted substrate classes from figure 1 included for comparison.

Seafloor character mapped in 2013. Bathymetric

GIS database and digital cartography by Mercedes D. Erdey and Nadine E. Golden

Manuscript approved for publication July 21, 2015

contours by Mercedes D. Erdey, 2013



(sand and gravel) and rock (that is, sediment typically forming a veneer over bedrock, or rock outcrops having little to no relief) make up 13.5 percent (18.7 km²) of the map area: 4.2 percent (5.8 km²) is in Depth Zone 2, and 9.3 percent (12.9 km²) is in Depth Zone 3. Rock and boulder, rugose (rock and boulder outcrops having high surficial complexity) makes up 15.2 percent (21.2 km²) of the map area: 8.6 percent (12.0 km²) is in Depth Zone 2, and 6.6 percent (9.2 km²) is in Depth Zone 3. Medium- to coarse-grained sediment (in scour depressions consisting of material that is coarser than the surrounding seafloor) makes up 2.0 percent (2.7 km²) of the map area: 1.2 percent (1.6 km²) is in Depth Zone 2 and 0.8 (1.1 km²) is in Depth Zone 3 (table 1).

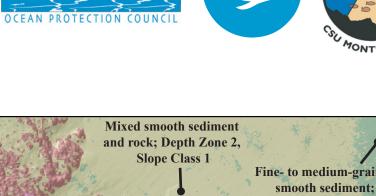
Table 1. Coverage of classified seafloor, in square kilometers (sq km) and percent of total area, broken into California Marine Life Protection Act Depth Zones 2 and 3.

	Total		Depth Zone 2 (water depth 0–30 m)		Depth Zone 3 (water depth 30–100 m)	
	percent	sq km	percent of total	sq km	percent of total	sq km
Fine- to medium- grained smooth sediment	69.3	96.2	22.7	31.5	46.6	64.7
Mixed smooth sediment and rock	13.5	18.7	4.2	5.8	9.3	12.9
Rock and boulder, rugose	15.2	21.2	8.6	12.0	6.6	9.2
Medium- to coarse grained sediment	2.0	2.7	1.2	1.6	0.8	1.1









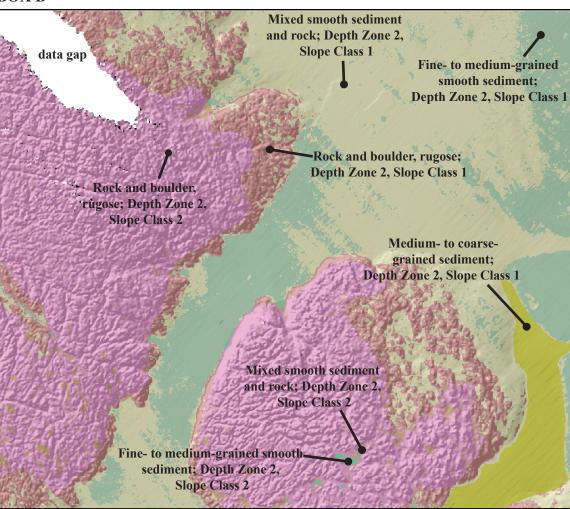


Figure 4. Detailed view of substrate classes mapped southeast of Bodega Head (see Box B, on map, for location): Depth Zone 2 (intertidal to 30 m), Slope Class 1 (0°–5°), and Slope Class 2 (5°–30°). Fine- to medium-grained smooth sediment is shown in shades of green; mixed smooth sediment and rock is shown in shades of tan; rock is shown in shades of pink; and medium- to coarse-grained sediment is shown in shades of yellow.

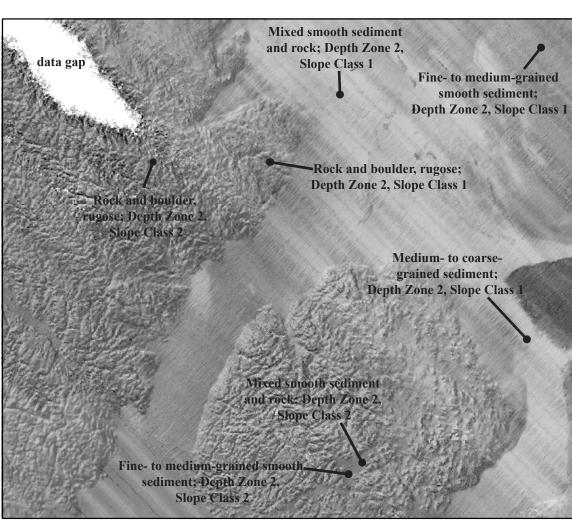


Figure 5. Acoustic-backscatter image (see sheet 3) draped over shaded-relief bathymetry (see sheet 2) for same area as figure 4 (Box B on map). Brighter areas indicate coarse-grained, rough, or hard seafloor; darker areas indicate unconsolidated (loosely packed) sediment. Parallel light- and dark-gray lines are data-processing

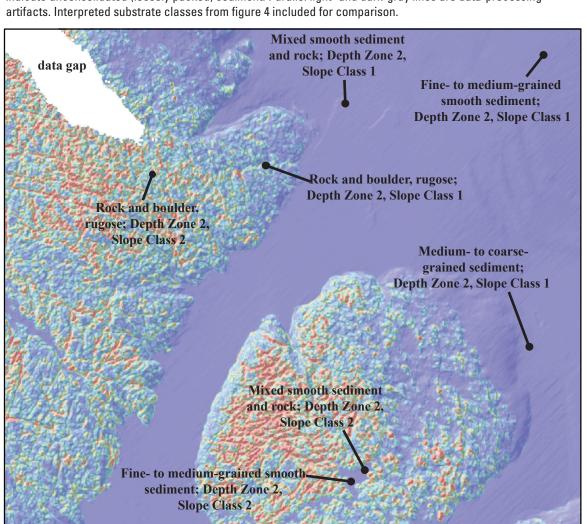


Figure 6. Rugosity (characterization of roughness derived from bathymetry) draped over shaded-relief bathymetry (see sheet 2) for same area as figure 4 (Box B on map). Rugosity values are displayed in muted "rainbow" color spectrum that ranges from purple (low rugosity) through green (medium rugosity) to red (high rugosity). Interpreted substrate classes from figure 4 included for comparison.

Any use of trade, product, or firm names in this publication is for descriptive purposes only and does not imply endorsement by the U.S. Government

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Digital files available at http://dx.doi.org/10.3133/ofr20151140

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BATHYMETRIC CONTOUR INTERVAL 10 METERS

ONE MILE = 0.869 NAUTICAL MILES